

**REMARKS**

Claims 1, 2 and 8-21 are currently pending. Support for the amendment to claim 1 may be found in the specification as originally filed, for example, in original claims 3, 4, 6 and 7 and at paragraphs [0023]-[0024] and [0034].

Support for the new claims may be found in the specification as originally filed, for example:

Claim 8	paragraphs [0019], [0020] and [0023];
Claim 9	paragraph [0008];
Claims 10 and 12	paragraph [0008];
Claim 11	the unnumbered paragraph following numbered paragraph [0020];
Claim 13	paragraph [0009] and [0018];
Claim 14 and 15	paragraph [0015];
Claim 16	the unnumbered paragraph following numbered paragraph [0027];
Claim 17	paragraph [0022];
Claim 18	the unnumbered paragraph following numbered paragraph [0023]; and
Claim 19-21	the unnumbered paragraph following numbered paragraph [0030]

**I. The Information Disclosure Statement Filed August 16, 2006**

Applicants filed an Information Disclosure Statement (IDS) on August 16, 2006. The Examiner is requested to consider the IDS and return an initialled copy of the PTO Form SB/08.

**II. The Rejection Under 35 U.S.C. §112**

Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite.

The Examiner states that the phrase "...a range of more than 600 to 900..." is not clear and questions whether the value in the range of 600-900 or is it more than 600?

The phrase "temperature falling within a range of more than 600 to 900°C" is clear and definite and means  $600^{\circ}\text{C} < T \leq 900^{\circ}\text{C}$ . However, to further prosecution, claim 2 is amended to recite "a temperature falling within a range between more than 600°C and 900°C". For consistency, Applicants' specification has also been amended (page 5, line 8; page 7, line 1; page 9, line 7; page 11, line 16; and page 16, line 12).

For the above reasons, it is respectfully submitted that Applicants' claims are clear and definite and it is requested that the rejection under 35 U.S.C. §112 be reconsidered and withdrawn.

If deemed preferable by the Examiner, Applicants offer to amend claim 2 to recite the formula  $600^{\circ}\text{C} < T \leq 900^{\circ}\text{C}$ .

**III. The Double Patenting Rejection**

Claims 1, 6 and 7 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1 and 6-7 of copending Application No. 10/735,844.

Independent claim 1 has been amended to include the subject matter of claims 3 and 4, which were not included in the obviousness-type double patenting rejection. For at least that reason, it is respectfully submitted that the subject matter of the pending claims is not obvious from the claims of copending Application No. 10/735,844 and it is requested that the obviousness-type double patenting rejection be reconsidered and withdrawn.

#### **IV. Summary of the Present Invention**

Prior to addressing the Examiner's specific rejections, Applicants submit the following brief summary of some of the features recited in claim 1 of the present invention. The summary is provided to the Examiner for the purposes of assisting the Examiner in understanding the claimed invention and the differences between the claimed invention and the cited art.

One of the features (Point A) of the present invention is lowering a temperature of the gas flow (including fullerenes and PAHs (polycyclic aromatic hydrocarbons)) having flowed through the first filter where soot is removed from the gas flow in a range of 300-600°C and then passing the gas flow through the second filter, thereby recovering fullerenes free of PAHs. Point A is achieved based on the assumption that fullerenes and PAHs are vaporized at a temperature of 600°C or more, and on the finding that fullerenes are in a solid state while PAHs are maintained in a gaseous state at a temperature between 300 and 600°C.

Another feature (Point B) of the present invention is that the reactor is an inverted type, provided with a burner at an upper portion of the reactor for either imperfectly combusting or thermally decomposing a hydrocarbon fuel and with an exhaust port at a lower portion of the reactor, through which the high-temperature gas flow containing fullerenes, PAHs, and soot is

discharged to outside of the reactor. Because of such a structure, soot generated by combustion or thermal decomposition and the flame from the burner are drawn downward. Therefore, clogging of the burner with the soot is prevented, and fullerenes can be produced continuously over an extended time since the soot is less likely to adhere onto the furnace wall of the reactor and regular cleaning of the reactor is not necessary. Original claims 6 and 7, paragraphs [0012] and [0015] disclose the reactor being an inverted type, provided with a burner at the upper portion of the reactor and with the exhaust port at the lower portion of the reactor.

**V. The Rejection Under 35 U.S.C. §102 Based on the Yoshikawa Article**

Claim 1 is rejected under 35 U.S.C. 102(a) as allegedly being anticipated by the Yoshikawa et al Journal Article.

Yoshikawa et al discloses a sintered metallic filter, PAHs and fullerenes, but does not teach Points A and B of the present invention. It is also noted that independent claim 1 has been amended to include the subject matter of claims 3 and 4, which were not included in the anticipation rejection based on Yoshikawa et al. It is respectfully submitted that the subject matter of the pending claims is not anticipated by or obvious from the disclosures of Yoshikawa et al and it is requested that the anticipation rejection be reconsidered and withdrawn.

**VI. The Rejections Based on Kronholm et al**

Claims 1-4 are rejected under 35 U.S.C. 102(e) as allegedly being anticipated by Kronholm et al (2004/0057896).

Claims 5-7 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kronholm et al.

Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kronholm et al (2004/0057896) in view of JP 06-056414.

Applicants respectfully submit that the present invention is not anticipated by or obvious over the disclosures of Kronholm et al and request that the Examiner reconsider and withdraw these rejections in view of the following remarks.

As to the anticipation rejection of claims 1-4, it is noted that claim 1 has been amended to include the subject matter of claims 6 and 7. Further, Kronholm et al discloses separating soot generated from a combustion chamber 215 by a solid/gas separator 230, and recovering gaseous fullerenes in a collector 250. Kronholm et al discloses a sieve filter, fiber filter, or a packed bed filter as a filter used in the solid/gas separator 230. As shown in FIG 3, Kronholm et al employs first and second collectors 310, 320, which are provided for separating fullerenes such as C60 and C70 but not for separating PAHs.

On the other hand, the present invention aims to recover fullerenes containing little PAHs by the second filter, taking advantage of the fact that fullerenes are solid and PAHs are gas at a temperature of 300 to 600°C. Furthermore, a gas-cooling apparatus is provided downstream of the second filter to lower a temperature of exhausted gases and to remove all or part of PAHs contained in the exhaust gases.

Kronholm et al employs the combustion chamber 215 having the burner 210 and an exhaust port at lower and upper portions thereof, respectively. However, the present invention employs an inverted reactor having a burner and an exhaust port at upper and lower portions thereof, respectively. Production of fullerenes by a combustion method results in generation of a

large amount of soot. In the present invention, most of the generated soot moves towards the bottom of the reactor along with the gas flow, and is discharged out of the reactor through the exhaust port because the exhaust port is provided at the lower portion of the reactor. However, Kronholm et al uses the combustion chamber provided with the burner at the lower portion thereof; thus, produced soot falls and accumulates on the burner, thereby hindering continuous operation of the apparatus. As a countermeasure, a flow rate of the gas stream during combustion can be enhanced to allow soot to move upward more easily. However, soot still deposits in the upper portion of the combustion chamber 215, and falls on the burner by its own weight. The present invention requires much less frequency of cleaning, and is suitable for continuous operation.

As to subject matter of claims 5-7, even if it is assumed to be obvious to adopt a sufficiently low temperature (less than 200 °C) for condensing fullerenes, it would not have been obvious to one skilled in the art in view of Kronholm et al to control the fullerene-containing gas having flowed through the first filter in a range of 300 to 600 °C and recover fullerenes free of polycyclic aromatic compounds in the second filter. Furthermore, the above-mentioned Point B is also a feature of the present invention.

Further to the subject matter of claims 6 and 7, it is not clear to us how Kronholm et al's of discussion distance from the burner relates to orientation of the burner. The Examiner appears to rely on that disclosure to support his conclusion that it would have been obvious to one of skill in the art to put the burner at the top of the reactor and the outlet at the bottom. Applicants respectfully submit that the Examiner has not provided support for his statement that "the burner

would be placed on top for various reasons, including removal of larger particles with the aid of gravity or because convenience due to location of feed piping and related equipment.” To the extent that the Examiner is taking “official notice” of knowledge in the art that is not supported by the cited art, Applicants respectfully request that the Examiner provide documentary evidence if the rejection is to be maintained. See MPEP §2144.03.

JP 06-056414 does not overcome the deficiencies in the primary reference, Kronholm et al, as discussed above. Therefore, even if the cited references are combined, it is respectfully submitted that it would not have been obvious to one of ordinary skill in the art to use Applicants’ claimed method.

For the above reasons, it is respectfully submitted that the subject matter of the pending claims is neither taught by nor made obvious from the disclosures of Kronholm et al, alone or in view of JP 06-056414, and it is requested that the rejections under 35 U.S.C. §§102 and 103 be reconsidered and withdrawn.

#### **VII. The Rejections Based on Alford et al**

Claim 1 is rejected under 35 U.S.C. 102(e) as allegedly anticipated by or, in the alternative, under 35 U.S.C. 103(a) as allegedly obvious over Alford et al (6,887,291).

Claims 2 and 5-7 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Alford et al (6,887,291).

Applicants respectfully submit that the present invention is not anticipated by or obvious over the disclosures of Alford et al and request that the Examiner reconsider and withdraw this rejection in view of the following remarks.

Independent claim 1 has been amended to include the subject matter of claims 3 and 4, which were not included in the rejections based on Alford et al.

Applicants note that in the examples of Applicants' specification, some of the devices used to make the apparatus were formed using devices purchased from the U.S. company to which Mr. Alford belongs. However, Alford et al does not disclose the feature of the present invention, i.e., recovering soot in the first filter, cooling down the gas flow containing fullerenes and polycyclic aromatic compounds to a temperature of 300 to 600 °C, thereby recovering only fullerenes in the second filter while allowing polycyclic aromatic compounds in a gas state to flow therethrough. Alford et al employs an upright reactor having a burner at a lower portions and an exhaust port at an upper portion. However, the present invention employs a reactor with a burner at an upper portion of the reactor and an exhaust port at a lower portion of the reactor, which is opposite to the upright reactor of Alford et al. Therefore, the present invention is advantageous in that burning of a hydrocarbon fuel in the burner disposed at the upper portion of the reactor allows generated soot to be discharged from the exhaust port at the lower portion of the reactor. Alford et al does not disclose the advantage of the present invention, and the present invention is not obvious from Alford et al.

Applicants respectfully submit that the claimed method for producing fullerenes by a combustion method, including a reactor provided with the burner at the upper portion thereof and the exhaust port at the lower portion thereof is novel and unobvious over the teachings of Alford et al.



Amendment Under 37 C.F.R. §1.111  
Application No. 10/735,824

For the above reasons, it is respectfully submitted that the subject matter of the pending claims is neither taught by nor made obvious from the disclosures of Alford et al, either alone or in combination, and it is requested that the rejections under 35 U.S.C. §§102 and 103 be reconsidered and withdrawn.

**VIII. Conclusion**

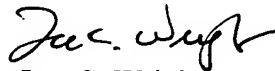
In view of the above, Applicants respectfully submit that their claimed invention is allowable and ask that the rejection under 35 U.S.C. §112 and the rejections under 35 U.S.C. §§102 and 103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.

If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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